DOCUMENT RESUME

ED 427 733 IR 019 284

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TITLE Evaluation Scale of Educational Web Sites.
PUB DATE 1998-11-00
NOTE 8p.; In: WebNet 98 World Conference of the WWW, Internet and Intranet Proceedings (3rd, Orlando, FL, November 7-12, 1998); see IR 019 231. Figures may not reproduce clearly.
PUB TYPE Reports - Descriptive (141) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Computer Assisted Instruction; Computer Oriented Programs; Educational Technology; Evaluation Criteria; Evaluation Methods; Instructional Effectiveness; Instructional Materials; Nonprint Media; Tables (Data); User Satisfaction (Information); *World Wide Web
IDENTIFIERS *Web Sites

ABSTRACT

This paper presents an Evaluation Scale which is applicable to various types of educational Web sites. It consists of three parts: composition of the site (concerned with general characteristics, presentation and illustration of information, and user's impression); pedagogical aspects; and curriculum-related aspects. Twenty-seven biology teachers who had previously passed an advanced in-service course in computer usage in their subject formed an expert group. They evaluated two Web sites, ranking 43 different statements in the Evaluation Scale according to their opinions of the presented sites. Evaluation results are presented, along with six figures showing the front pages of the two Web sites and response tabulations. The paper concludes that the Evaluation Scale should be applicable to instructional Web sites of different countries. (AEF)

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Evaluation Scale of Educational Web Sites

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ED 427 733

Abstract: As a result of the present work the criteria for evaluating educational Web sites have been worked out. A special Evaluation Scale considering curriculum guidelines have been developed. The presented Scale is supposed to be applicable in evaluation of different types of educational Web sites. It consists of three parts: composition of the site, pedagogical aspects and curriculum-related aspects. The first part - composition of the site - is divided into three units: general characteristics, presentation and illustration of information and user's impression. 27 teachers who had previously passed an advanced in-service course in usage of computers in school biology formed an expert group. They examined and evaluated two educational Web sites - "Estonian Vertebrates" and "Arthropods". Teachers ranked 43 different statements in the Evaluation Scale according to their opinions of the presented Web sites. The analysis of their answers demonstrated the advantage of "Estonian Vertebrates" in some aspects compared with "Arthropods".

Introduction

There are numbers of educational recourses available on Internet varying in their composition and contents. Some of these have been assigned to educators, the others directly to basic or secondary school students. Several textbooks provide information about the composition and design of effective instructional Web site (e.g. Edwards & Holland, 1994; Boyle, 1997); some of these include curriculum context (e.g. Jones & Scrimshaw, 1988; Ross & Scanlon, 1995). The efficiency of application of educational Web sites in learning process depends on many aspects. Therefore, it is essential to clarify all the evaluation aspects related to the educational Internet resources. Obviously the same criteria can be considered both in creating effective instructional Web site and in the evaluation of educational resources available on Internet. As a minimum, the evaluation process must take into consideration technical and pedagogical aspects. A good example connecting two mentioned aspects can be examined on Internet (Jones, 1998). However, the evaluation of educational Web pages must also include the curriculum- and subject-related aspects.

Evaluation Scale

We selected three different groups of questions essential for evaluating an effective educational Web site: composition of interface, general pedagogical considerations and applicability in curriculum context. According to this the proposed Evaluation Scale of educational Web Site consisted of three parts: composition of the site, pedagogical aspects and curriculum-related aspects. Each question was presented as a statement. Teachers had to evaluate all the statements using the five-point scale, where the value of 1 corresponded to complete disagreement and 5 - to complete agreement. They could choose 0 when they could not evaluate the statement or find the answer.

The first part of the Evaluation Scale - composition of the site - is concerned with general characteristics, presentation and illustration of information and user's impression. This part can be titled as the Web-based Design Scale and was adopted from Jones (1998).

The first unit of this part embraces general characteristics. The target audience and the objectives should always be taken into consideration in composing educational Web site. Everybody starting to examine the educational Web site must get a quick survey of the orientation and the scope of the site. Similar design principles, suitable navigation devices and appropriate layout enhance finding information and thereby facilitate the learning process. Obviously there are some differences in the application of instructional Web site between the students of basic and secondary school.

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I. Composition of the Site

A. General Characteristics

1. It is easy to open the program. (1-2-3-4-5 0)
2. The objective of the site is clearly presented. (1-2-3-4-5 0)
3. The target audience of the presented material is clearly comprehensible. (1-2-3-4-5 0)
4. It is easy to estimate the scope of the presented information. (1-2-3-4-5 0)
5. The site is a complete unit. (1-2-3-4-5 0)
6. The layout of all the presented material is appropriate. (1-2-3-4-5 0)
7. The same design principles are used. (1-2-3-4-5 0)
8. The navigation in the site is easy. (1-2-3-4-5 0)
9. The navigation devices are suitable for basic school students. (1-2-3-4-5 0)
10. The navigation devices are suitable for secondary school students. (1-2-3-4-5 0)

The second unit of the first part concentrates on the presentation and illustration of information. Design of the front page must be attractive and all the information on it clearly understandable for the learners. The appropriate structure of hypertext, illustrations, sound, video and animation must form a complete unit. All these aspects enhance the presentation of information and overall the effectiveness of the application of educational Web site.

B. Presentation and Illustration of Information

11. The front page is reasonable and comprehensible. (1-2-3-4-5 0)
12. The layout of the text supports reading. (1-2-3-4-5 0)
13. The appropriate font is used. (1-2-3-4-5 0)
14. The colors of the text are reasonable and consistent. (1-2-3-4-5 0)
15. The quality of illustrations is good. (1-2-3-4-5 0)
16. The photos enhance the presentation of the information. (1-2-3-4-5 0)
17. The figures enhance the presentation of the information. (1-2-3-4-5 0)
18. The audio enhances the presentation of the information. (1-2-3-4-5 0)
19. The video enhances the presentation of the information. (1-2-3-4-5 0)
20. The animation enhances the presentation of the information. (1-2-3-4-5 0)

The user's positive impressions increase the learner's interest to the subject and therefore increase the learning motivation. According to this there were some questions about user's impressions in the third unit of the first part. However, the opinions of evaluators might be different - teachers and students are not always of one mind.

C. User's Impression

21. The site is engaging and invites to use. (1-2-3-4-5 0)
22. The site is composed creatively. (1-2-3-4-5 0)
23. The site is well done. (1-2-3-4-5 0)
24. The site is enjoyable. (1-2-3-4-5 0)

The second part of the Evaluation Scale rates several attitudes on educational philosophy, goal orientation, motivation, metacognitive support, and advantage of learning strategies and structural flexibility. All these aspects must be considered in designing an effective educational Web site (Reeves & Reeves, 1997; Philips, 1997). The evaluation of pedagogical aspects presumes the appropriate educational background. Therefore, teachers were provided with some additional explanations in our case study.

II. Pedagogical Aspects

25. Pedagogical philosophy (instructivist - constructivist). (1-2-3-4-5 0)
26. Goal orientation (sharply focused - general). (1-2-3-4-5 0)
27. Source of motivation (extrinsic - intrinsic). (1-2-3-4-5 0)
28. Teacher's presence in using of the site (not necessary - obligatory). (1-2-3-4-5 0)
29. Metacognitive support (does not provide feedback - provides feedback). (1-2-3-4-5 0)

30. Collaborative learning strategies (unsupported - supported). (**1-2-3-4-5 0**)
31. Structural flexibility (fixed - open). (**1-2-3-4-5 0**)

The third part of the Scale embraces curriculum-related aspects. In this part an essential group of questions includes the relation of educational Web site with the concepts of Estonian new State Curriculum. However, the same guidelines can be found in the curricula of the most countries. We were interested if the presented Web site is applicable in teaching various themes of curriculum, but also in extra-curriculum activities. One obvious prerequisite for successful usage of instructional Web site is that all the texts and presented materials are correct in its content and comprehensible by the users. The application of some instructional Web sites might be accompanied with supplementary materials. Therefore, this aspect was also under consideration.

III. Curriculum-Related Aspects

32. The site is related to the themes of the curriculum. (**1-2-3-4-5 0**)
33. The site is applicable while teaching various themes of curriculum. (**1-2-3-4-5 0**)
34. The site is also applicable in several extra-curriculum activities. (**1-2-3-4-5 0**)
35. The presented material is correct in its content. (**1-2-3-4-5 0**)
36. The content of the information is comprehensible for basic school students. (**1-2-3-4-5 0**)
37. The content of the information is comprehensible for secondary school students. (**1-2-3-4-5 0**)
38. The formulation of texts is well adapted to basic school students. (**1-2-3-4-5 0**)
39. The formulation of texts is well adapted to secondary school students. (**1-2-3-4-5 0**)
40. There are lots of incomprehensible terms in the topics. (**1-2-3-4-5 0**)
41. All the terms are well explained. (**1-2-3-4-5 0**)
42. The material of the site is applicable without supplementary materials. (**1-2-3-4-5 0**)
43. The material of the site is usable in computerized biology classes. (**1-2-3-4-5 0**)

Educational Web Sites

Two educational Web sites have been examined in the evaluation process - "Estonian Vertebrates" and "Arthropods" (Fig. 1). The first one has specially been composed for basic and secondary school students in our Department. It considers the guidelines of Estonian new Sate Curriculum (Sarapuu, 1997). The second one - "Arthropods" - has been designed in the Institute of Zoology and Botany (Estonia). In developing the latter no special efforts towards the curriculum content were done.

The main part of "Estonian Vertebrates" Web site (*http://sunsite.ee/loomad/*) is a database about five groups of Estonian vertebrates: fishes, amphibians, reptiles, birds and mammals. It includes general information about vertebrates, lists of all the species of Estonian vertebrates and survey of all the groups emphasizing the local Estonian aspects. The most common (ca 300) species are provided with detailed descriptions, color photos and voices. "Estonian Vertebrates" has been developed in order to be applicable in biology classes both in basic and secondary school. Therefore the information about each species has been presented on two Web pages considering students' different age and abilities. The first page gives general information about particular species including its appearance, distribution, abundance, feeding, reproduction, development and endangerment. This one is mainly orientated to the basic school students. Considering this, the first page has fewer scientific facts and simpler vocabulary whereas the second one - supplementary information page - has some more terms and scientific information. This additional material is mainly assigned to the secondary school students (Adojaan & Sarapuu, 1997).

The principles of composition of "Arthropods" Web site (*http://www.zbi.ee/satikad/*) are completely different. It gives a systematic survey of all the classes and orders of Arthropods. It is composed as an attractive supplementary reading material to encourage students to study Estonian nature. Different groups of Arthropods are characterized by their morphology, anatomy and physiology (e.g. reproduction, development, feeding, adaptations, etc.). An essential part of each topic is the information about the behavior and adaptation of Arthropods. The data of their ecology are concerned with interactions with environment, plants and other animals. "Arthropods" Web pages are illustrated with original colour photos, schemes and drawings. The presented material is not so directly meant for the basic or secondary school students, but for everybody interested in the life of Arthropods and generally in Estonian nature.

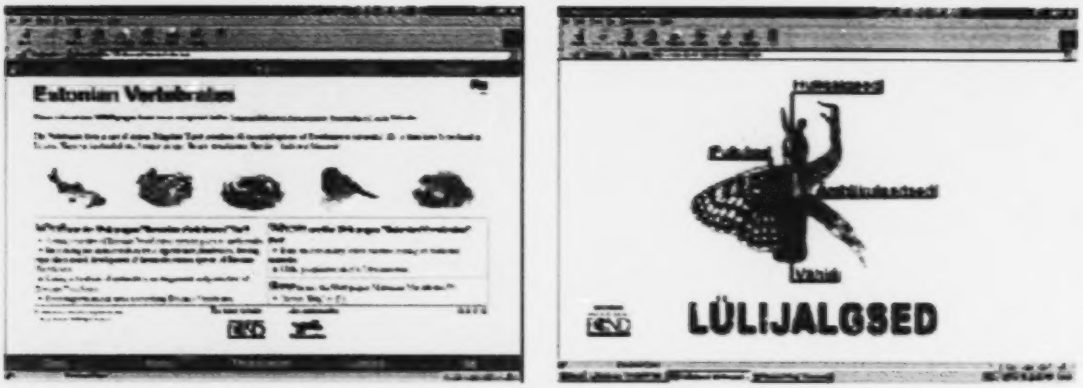

Fig. 1. The front pages of "Estonian Vertebrates" (on the left) and "Arthropods" (on the right) Web sites.

An Expert Group

An expert group consisting of 27 biology teachers had previously passed an advanced in-service course in usage of computers in school biology. Teachers came from different regions of Estonia and had some previous experience in the application of computers in teaching biology in basic or secondary school.

At first, an introductory lecture about the concepts of evaluation of educational software and instructional Web sites was conducted to the teachers. Subsequently, they had the opportunity to get acquainted with two Web sites - "Estonian Vertebrates" and "Arthropods". At the same time they participated in the evaluation process based on the Scale described in the previous section.

Results

27 biology teachers evaluated "Estonian Vertebrates" Web site and 22 of those ranked the proposed aspects of "Arthropods". The first unit of the first part of the Evaluation Scale was concerned with general characteristics. The average ranks calculated from the teachers' opinions (Fig. 2) revealed that the target audience and the objective of "Estonian Vertebrates" Web site are more clearly presented (questions 2 and 3, respectively). This result is closely related to the question number 11 of the second unit - "the front page is reasonable and comprehensible" (Fig. 3). The front page of "Estonian Vertebrates" is more informative, than the first page of "Arthropods" which appears to be more illustrative than informative. Teachers also thought that the navigation devices on "Estonian Vertebrates" Web site were more convenient (question 8).

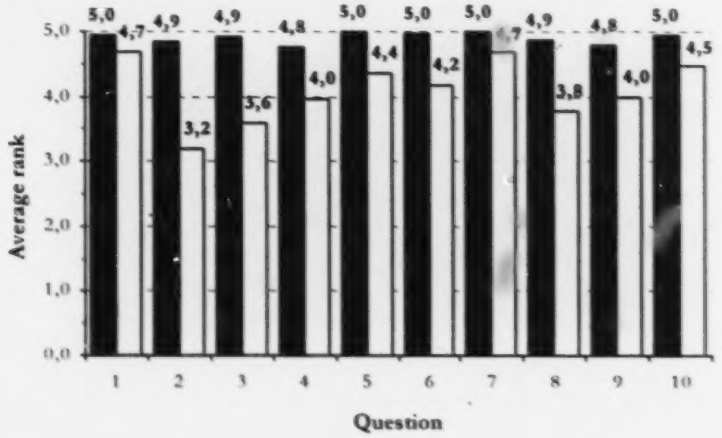

Fig. 2. The average ranks of the general characteristics of "Estonian Vertebrates" (+) and "Arthropods" ( ) Web sites.

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The second unit was concerned with the presentation and illustration of information (Fig. 3). One of the greatest advantages of "Estonian Vertebrates" Web site is that it is provided with real voices of nature - several species are characterized not only with text but also with their voices (question 18). As far as birds are concerned, their song is an essential feature in recognizing them in nature. Neither "Estonian Vertebrates" nor "Arthropods" Web site includes video and animation. Therefore, some questions of this unit are not applicable with these Web sites.

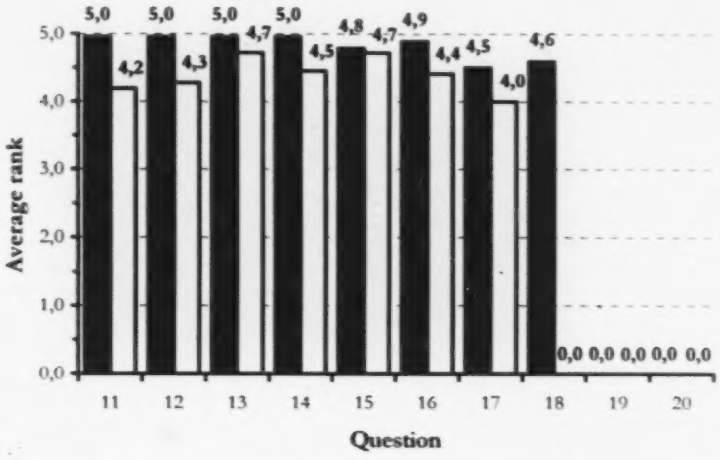

Fig. 3. The average ranks of the presentation and illustration of information on "Estonian Vertebrates" (+) and "Arthropods" ( ) Web sites.

The third unit asked for the user's impressions. Teachers valued "Estonian Vertebrates" Web site higher in all the aspects (Fig. 4). This result proves that "Estonian Vertebrates" Web pages are more attractive and enjoyable. Considering this it is suggested that the material presented on "Estonian Vertebrates" Web site enhances the learner's motivation and interest in school biology.

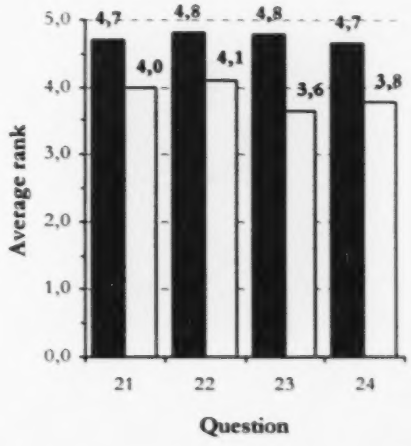

Fig. 4. The average ranks of the user's impression concerning "Estonian Vertebrates" (+) and "Arthropods" ( ) Web sites.

The second part of the present Evaluation Scale studied pedagogical aspects of two Web sites. There were no essential differences in the teachers' opinions (Fig. 5). The "Estonian Vertebrates" was thought to be more gener-

ally focused compared with the orientation of "Arthropods" Web site (question 26). The teachers' answers also revealed that "Arthropods" provides more possibilities for feedback (question 29).

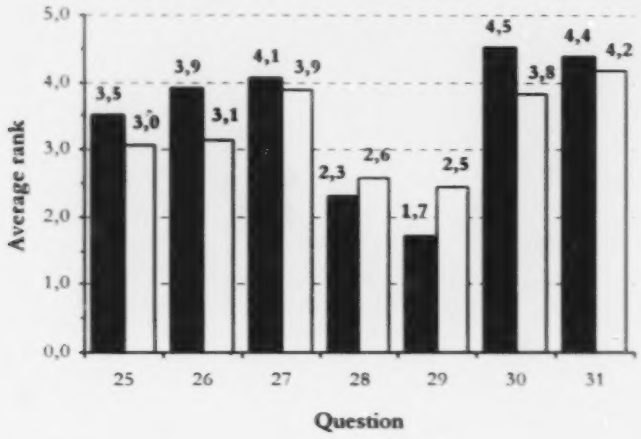

Fig. 5. The average ranks of the pedagogical aspects on "Estonian Vertebrates" (+) and "Arthropods" ( ) Web sites.

The last part of the Evaluation Scale rated the curriculum-related aspects (Fig. 6). Both sites are applicable in teaching various themes of curriculum (questions 32, 33), but also in extra-curriculum activities (34). The main difference between "Estonian Vertebrates" and "Arthropods" Web sites is in their vocabulary. There are more incomprehensible terms in the topics of "Arthropods" (40). The scientific terms are well explained in the texts of "Estonian Vertebrates" (41) and therefore the presented material is better comprehensible by the basic school students (36). The successful application of "Arthropods" Web site depends on supplementary materials (42).

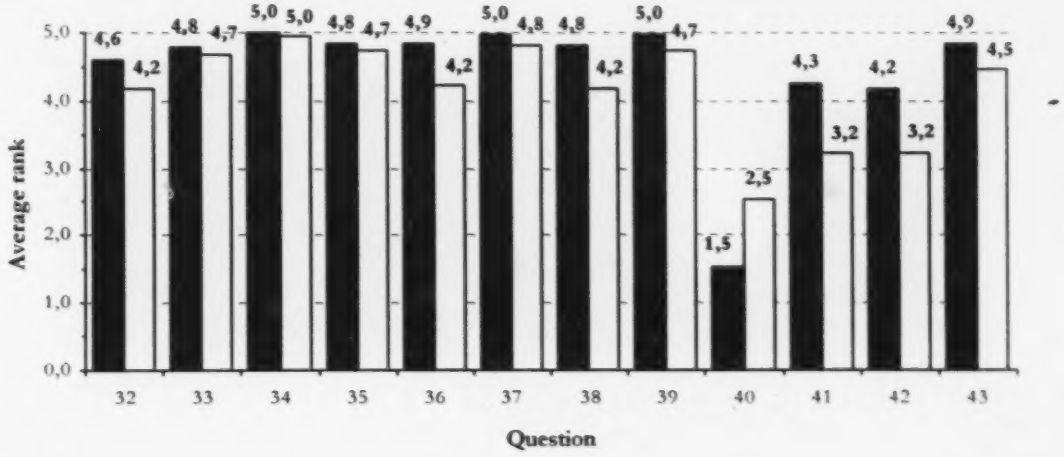

Fig. 6. The average ranks of the curriculum-related aspects on "Estonian Vertebrates" (+) and "Arthropods" ( ) Web sites.

Several criteria for evaluating the educational Web sites have been chosen as a result of the present work. Consequently a special Evaluation Scale consisting of 43 questions has been worked out. The Evaluation Scale

considers several curriculum-related aspects. This is the main difference of the proposed scale compared with the others. It is supposed that present Evaluation Scale is not only applicable with educational Web sites connected with Estonian State Curriculum but also with various instructional Web sites of different countries.

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